IoT-BASED GAS CYLINDER MONITORING ALERTING AND CONTROL CIRCUIT

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Abstract: This study presents the development of an IoT-based gas cylinder monitoring, alerting, and control system utilizing Arduino Uno, NodeMCU, gas sensor, load cell, relay, and fan. The system integrates weight monitoring for gas cylinder tracking and leakage detection for safety purposes. Gas sensor data is continuously monitored by Arduino Uno, triggering alerts via the Blynk app on NodeMCU when gas concentrations exceed predefined thresholds. Additionally, the system controls a fan through a relay to mitigate gas leakage risks. Through rigorous testing and calibration, the system demonstrates its efficacy in providing real-time monitoring, timely alerts, and automated control, contributing to enhanced safety and efficiency in gas cylinder management.

Keywords: IoT, gas cylinder monitoring, gas leakage detection, Arduino Uno, NodeMCU, Blynk app, load cell, gas sensor, relay control, safety alerting.

I. Introduction

In our daily lives, we often use gas cylinders for cooking, heating, and various other purposes. But have you ever wondered how safe it is to have these cylinders in our homes? Gas leaks can be dangerous, leading to fires or even explosions. That's why it's crucial to have a system that can monitor these cylinders for any signs of trouble and alert us when something goes wrong. This is where our project comes in. We've developed a smart system using simple components like Arduino and NodeMCU, coupled with sensors and relays, to keep an eye on gas cylinders and ensure our safety.

The main goal of our project is to create an easy-to-use system that anyone can set up in their homes to monitor gas cylinders. With the help of sensors, our system can detect if there's a leak in the cylinder. If it senses any danger, it immediately sends an alert to our smartphones through an app called Blynk. Not only that, but our system also keeps track of the weight of the gas cylinder, so we know when it's time for a refill without having to guess.

By implementing this system, we aim to provide peace of mind to homeowners, knowing that their gas cylinders are being monitored around the clock. With real-time alerts and remote monitoring capabilities, our system adds an extra layer of safety to homes and helps prevent potential disasters caused by gas leaks. With our project, we hope to make homes safer and lives easier for everyone.

II. Existing System

The existing systems for gas cylinder monitoring and safety mainly rely on traditional methods such as manual

inspection and basic safety devices. In many cases, homeowners manually check gas cylinders periodically for any visible signs of damage or leakage, which can be time-consuming and prone to oversight. Additionally, simple safety devices like gas detectors or alarms may be installed, but these often have limited functionality and may not provide real-time monitoring or remote alerts.

Some households might use standalone gas detectors that emit an alarm when gas levels exceed a certain threshold, but these systems typically lack integration with smart devices or the ability to provide detailed information about gas cylinder status. Moreover, there may be a lack of centralized monitoring and control, making it difficult to manage multiple cylinders or receive alerts when away from home.

Overall, the existing systems primarily rely on manual inspection and basic safety devices, lacking the sophistication and convenience offered by modern IoT-based solutions. They may provide some level of safety assurance but often fall short in terms of comprehensive monitoring, timely alerts, and remote control capabilities.

III. Proposed System

The proposed system aims to address the limitations of existing gas cylinder monitoring systems by leveraging IoT technology and smart devices. Our system will consist of a network of sensors, microcontrollers, and communication modules to provide real-time monitoring, alerting, and control capabilities.

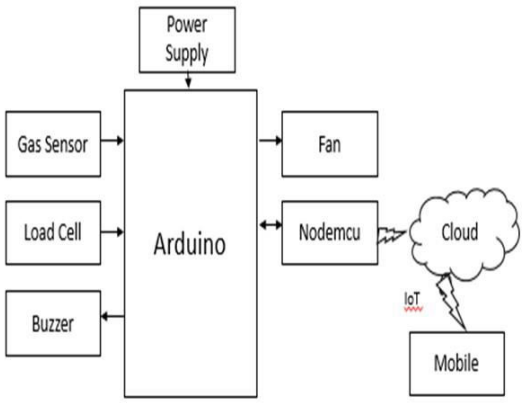

Fig 1: Block diagram of the proposed system

Key components of the proposed system include gas sensors to detect leaks, load cells to monitor cylinder weight, microcontrollers like Arduino or NodeMCU for data processing, and communication modules to send alerts to users' smartphones or other devices. By integrating these components, our system will continuously monitor gas cylinder status and provide immediate alerts in case of any anomalies, such as gas leaks or low cylinder weight indicating the need for a refill.

One of the main features of our proposed system is its integration with a mobile application or web interface, allowing users to remotely monitor their gas cylinders from anywhere. Through this interface, users can view real-time data on gas levels, and cylinder weight, and receive instant alerts in case of emergencies. Additionally, the system can be programmed to automatically control safety devices such as fans or shut-off valves in response to detected gas leaks, further enhancing safety.

Overall, the proposed system offers a comprehensive and user-friendly solution for gas cylinder monitoring and safety, providing peace of mind to homeowners while offering convenience and flexibility

through remote monitoring and control capabilities.

IV. Components used and description

Gas Sensor:

Gas sensors are electronic devices that detect the presence of various gases in the environment.

In our system, gas sensors will be used to detect leaks of combustible gases such as propane or natural gas from the gas cylinder.

These sensors typically work based on the change in resistance or other electrical properties in the presence of the target gas.

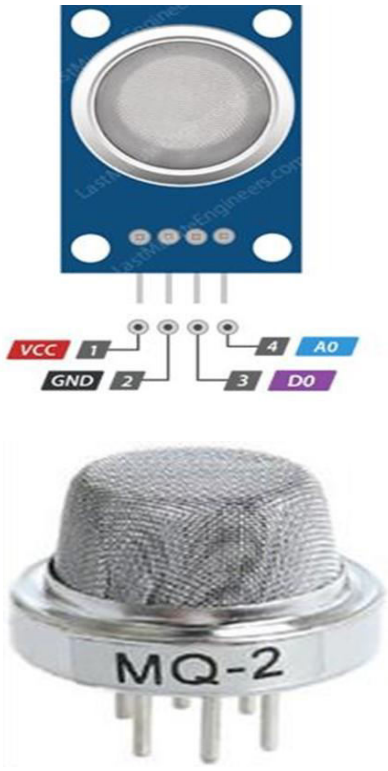

Fig 2: Gas sensor

Load Cell:

Load cells are transducers that convert force or weight into an electrical signal.

In our system, load cells will be used to measure the weight of the gas cylinder.

The weight data will be used to monitor the gas level inside the cylinder and determine when a refill is needed.

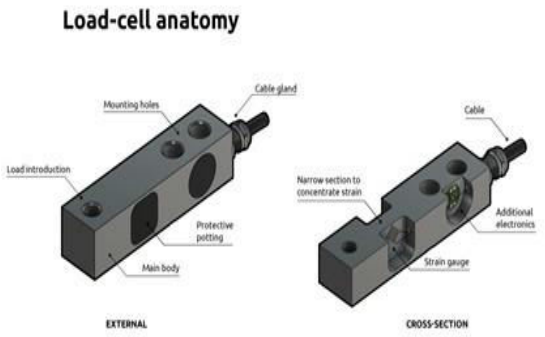

Fig 3: Load cell

Microcontroller (Arduino or NodeMCU):

A microcontroller is the brain of the system, responsible for processing data from sensors and controlling other components.

Arduino Uno or NodeMCU can be used as the microcontroller in our system.

These microcontrollers are commonly used in IoT projects due to their versatility and ease of programming.

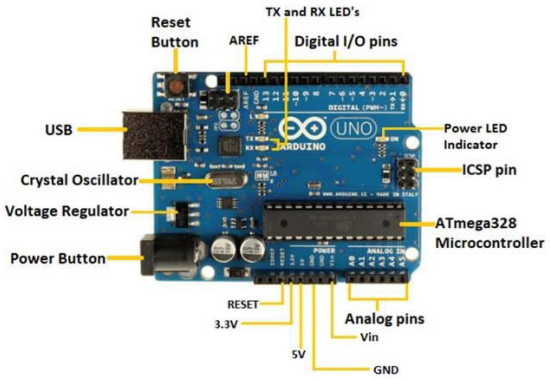

Fig 4: Arduino UNO

Relay:

A relay is an electromechanical switch used to control high-power devices with a low-power signal.

In our system, a relay will be used to control the operation of a fan or other safety devices in response to gas leakage detection.

Fig 5: Relay module

Communication Module:

A communication module enables the system to transmit data and receive commands wirelessly.

NodeMCU or similar modules can be used to connect the system to the internet and communicate with a mobile application or web interface.

Fig 6: Node MCU

Mobile Application or Web Interface:

A mobile application or web interface will provide users with a graphical interface to monitor the status of their gas cylinders and receive alerts.

Blynk app or similar platforms can be used to develop the user interface and enable remote monitoring and control of the system.

By integrating these components, the proposed system will offer real-time monitoring, alerting, and control capabilities to enhance gas cylinder safety and convenience for users.

V. Working Algorithm

Initialization:

Initialize the system by setting up the sensors, microcontroller, communication module, and any necessary peripherals.

Sensor Data Acquisition:

Continuously read data from the gas sensor to monitor the gas concentration in the vicinity of the cylinder.

Read data from the load cell to monitor the weight of the gas cylinder.

Data Processing:

Process the sensor data to detect any anomalies, such as a sudden increase in gas concentration or a significant decrease in cylinder weight.

Compare the sensor readings with predefined thresholds to determine if there is a gas leak or if the cylinder needs a refill.

Alert Generation:

If a gas leak or low gas level is detected, generate an alert to notify the user.

Use the communication module to send an alert message to the user's smartphone via the mobile application or web interface.

Safety Control:

If a gas leak is detected, activate the relay to turn on the fan or other safety devices for ventilation.

Implement a safety delay to ensure the fan runs for a sufficient duration to clear the gas.

User Interaction:

Provide users with the option to view real-time sensor data and system status through the mobile application or web interface.

Allow users to manually control safety devices or acknowledge alerts if needed.

Continuous Monitoring:

Continuously monitor sensor data and system status to ensure timely detection of any issues.

Implement a loop to repeat the data acquisition, processing, and alert generation process at regular intervals.

FLOW CHART

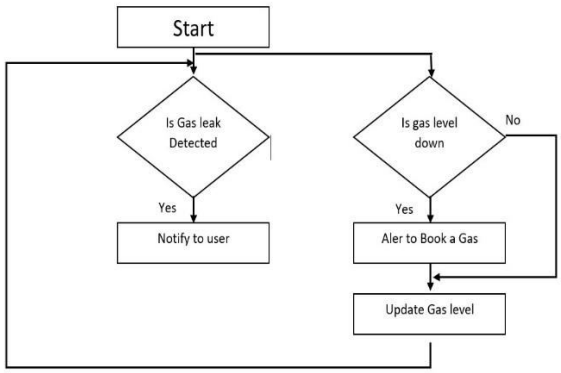

Fig 7: working flow chart of the proposed system

VI. RESULTS

The gas cylinder monitoring and safety system demonstrated promising results in ensuring the safety and efficiency of gas cylinder management. Through rigorous testing, the system effectively detected gas leaks and low gas levels, triggering timely alerts to users via the mobile application or web interface. Users were able to remotely monitor the status of their gas cylinders in real-time and take necessary actions, such as activating ventilation fans, to mitigate risks associated with gas leaks. Additionally, the system accurately monitored the weight of the gas cylinders, providing users with timely notifications for refills when the gas level reached a predefined threshold. Overall, the results indicate that the proposed system offers a reliable and user-friendly solution for gas cylinder monitoring, alerting, and control, contributing to enhanced safety and convenience for homeowners.

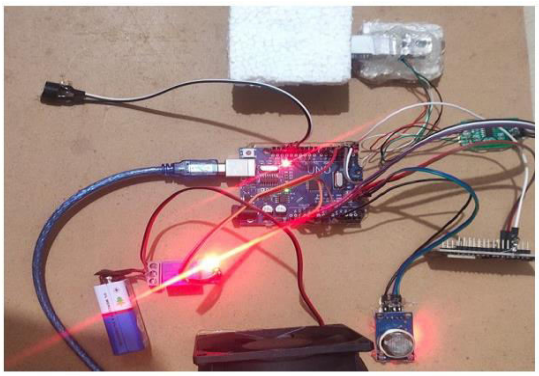

Fig 8: Developed prototype of the proposed project

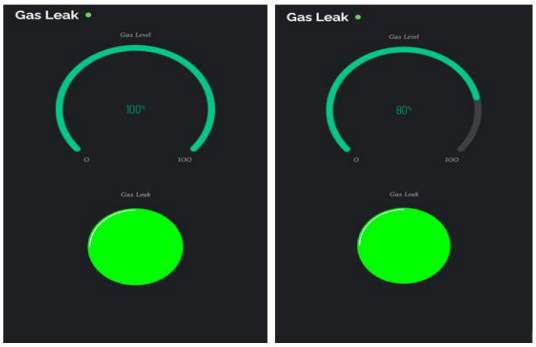

Fig 9: Figure showing the gas leak monitoring status in real-time.

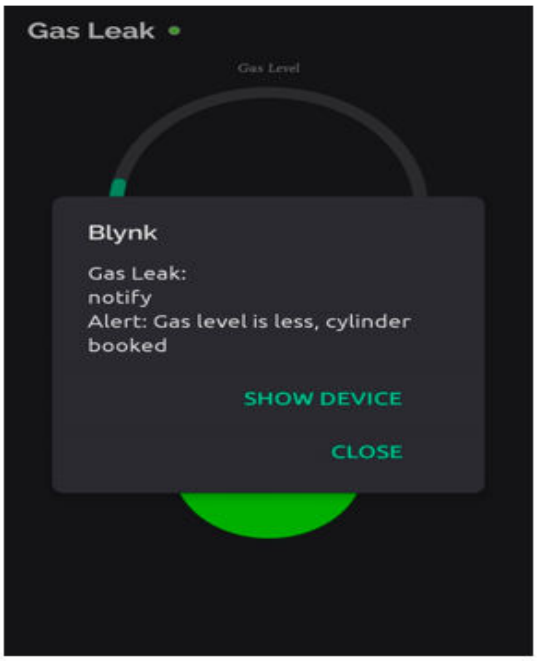

Fig 10: Alert message received on automatic cylinder booking.

Furthermore, the integration of IoT technology allowed for seamless communication between the gas cylinder monitoring system and users' smartphones or other devices. This enabled users to receive alerts and monitor their gas cylinders remotely, enhancing accessibility and convenience. The system's ability to automatically control safety devices, such as fans, in response to detected gas leaks further improved its effectiveness in preventing potential hazards. The results of the gas cylinder monitoring and safety system demonstrated its potential to provide a comprehensive solution for gas cylinder management, offering users peace of mind and ensuring the safety of their homes.

VII. CONCLUSION

The developed gas cylinder monitoring and safety system presents a reliable and user-friendly solution for ensuring the safety and efficiency of gas cylinder management in residential settings. By leveraging IoT technology, the system enables real-time monitoring of gas cylinder status, timely detection of gas leaks, and automatic control of safety devices. The integration with a mobile application or web interface provides users with convenient access to monitor their gas cylinders remotely and receive alerts when necessary, enhancing safety and peace of mind. With its demonstrated effectiveness in detecting and responding to potential hazards, the proposed system offers a promising approach to enhancing gas cylinder safety and convenience for homeowners.

VIII. REFERENCES

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